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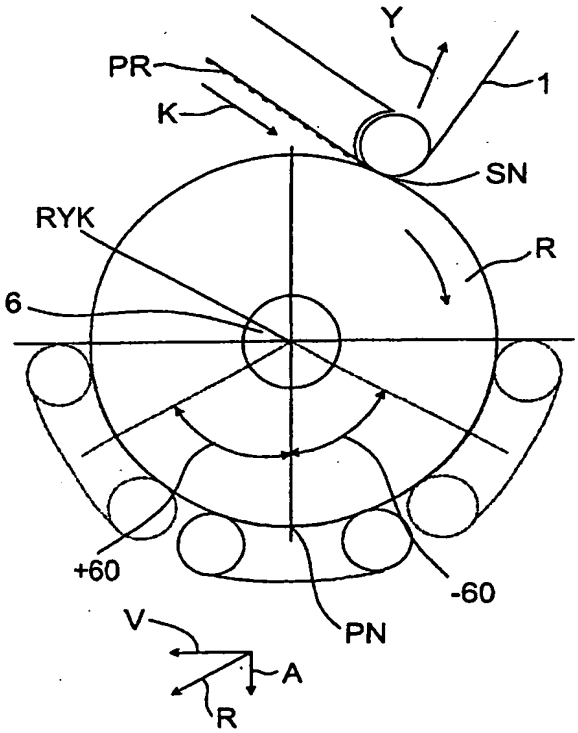
(57) Abstract

The invention relates to a method in reeling up, wherein paper reels are continuously formed on reeling cores from a continuous paper web. According to the invention, the paper reel (PR) is brought to the formation of the paper reel by utilizing a closed supporting belt rotation (1), on the outer surface of the supporting belt rotation (1). Further, the paper web (PR) is transferred from the outer surface of the supporting belt rotation (1) directly on the paper reel (R) formed on a reeling core. Thus a first nip contact (SN) is maintained substantially at that point of the supporting belt rotation (1) in which the paper web (PR) is transferred to the paper reel (R) that is being formed, and in addition to the first nip contact (SN), the paper reel (R) that is being formed is affected with at least one, second nip contact (PN). The invention also relates to a reel–up applying the method.



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A method in continuous reel-up of a paper web, and a reel-up

The invention relates to a method according to the preamble of claim 1 in continuous reeling up of a paper web.

There are various prior art methods for conducting the reeling up process. As an example of this state of the art reference is made to the publication EP-697006, which discloses a reeling up method, in which a paper web is guided from a stationary creasing roll directly to the reeling cylinder establishing a nip contact, from the surface of which the paper web is transferred directly to the paper reel to be formed on a reeling core. The location of the nip contact on the periphery of the paper reel that is being formed is altered in such a manner that at the final stage of the formation of the paper reel the reeling cylinder is capable of receiving a new reeling core on its outer periphery, positioning itself underneath the reeling core. The reel change takes place by means of a separate device arranged for this purpose, which moves with respect to the machine frame.

In the reeling up processes the web speeds are constantly increased. Thus, for example the method in the reeling up disclosed in the publication EP-697006 is disadvantageous especially in view of the overall control of the reeling up of the paper web.

It is an aim of the present invention to introduce a method by means of which it is possible to attain considerable advantages in continuous reeling up of a paper web at high web speeds, thus enhancing the state of art prevailing in the field. To attain these purposes, the method according to the invention is primarily characterized in that

- the paper web is brought to the formation of the paper reel by using a closed supporting belt rotation, on the outer surface of the supporting belt rotation,
- the paper web is transferred from the outer surface of the supporting belt rotation directly to the paper reel to be formed on the reeling core,

- a first nip contact is maintained substantially at that point of the supporting belt rotation in which the paper web is transferred to the paper reel that is being formed, and
- in addition to the first nip contact, the paper reel that is being formed is affected with at least one, second nip contact.

By means of the above-presented solution it is possible to gain such an advantage that at high web speeds, first of all, the transfer of the paper web to the paper reels can be conducted in a controlled manner, wherein by means of the nip contact maintained at this point, it is possible to perform measures affecting the formation of the paper reel in the nip contact, and secondly, it is then possible to utilize the second nip contact to produce other control variables important for the formation of the paper reel.

The appended dependent claims relating to the method present some preferred embodiments of the method.

The invention also relates to a reel-up according to the preamble of the independent claim relating to the reel-up. By means of the reel-up it is possible to attain the advantages according to the method, wherein the reel-up is primarily characterized in that the reel-up comprises:

- a closed supporting belt rotation, which is arranged to transfer the paper web to the formation of the paper reel on the outer surface of the supporting belt rotation, and from the outer surface directly to the paper reel to be formed on the reeling core,
- a first nip contact substantially at that point of the supporting belt rotation in which the paper web is transferred to the paper reel to be formed, and
- at least one second nip contact in addition to the first nip contact.

The appended dependent claims relating to the reel-up present some advantageous embodiments of the reel-up.

As for the terminology used in this description, the following remarks are made

- "passing" refers in this description to the process in which the cut end of the paper web is transferred past the outer periphery of the paper reel, advantageously also in such a manner that it touches the full paper reel substantially tangentially in the beginning of the reel change situation,

- "reeling core" refers in this description both to the material reeling core and to a non-material reeling core, i.e. the initial fulcrum of the reeling up process in which the paper web begins to be wound on the reel,

- "supporting belt" or "supporting belt rotation" refers in this description to such a substructure which is as wide as the paper web and enables the act of supporting the paper web and the transfers of the cut end,

- "machine direction" refers in this description to the longitudinal direction of the paper web, and

- "threading" refers in this description to the cutting of the paper web implemented as diagonal cutting as well as to the cutting of the paper web implemented in full-width, and the guiding of the web forward in the reel change situation.

The method and reel-up according to the invention will be illustrated in more detail in the following description, in which reference is made to the embodiments shown in the appended drawings. In the drawings

Figs. 1a to d show a schematical side-view of a first basic embodiment of the reel-up intended for applying the method according to the invention, and the stages (a to d) of the reel change implemented by means of the same,

Figs. 2a to f show a top view of certain stages (a to f) of the first embodiment according to Figs. 1 to 4,

Fig. 3 shows a shematical side-view of a reeling carriage used in connection with the first basic embodiment of the reel-up according to the invention,

Fig. 4 shows the actuators located in connection with the reeling carriage, seen in the direction IV of Fig. 3,

Fig. 5 shows a schematical side-view of the overall function of a second basic application,

Figs. 6a to 6d show a schematical side-view of the function of the second basic application of the reel-up according to the invention in a phase diagram (a to d), and

Figs. 7a to 7c show a top-view of the function of the second embodiment according to Fig. 5 in stages (a to c) in a smaller scale, and

Fig. 8 shows a side-view of the general principle of the method according to the invention.

Fig. 8 shows a side-view of the general principle of the method according to the invention. A closed supporting belt rotation 1 (will be described in more detail hereinbelow) brings the paper web PR on the outer surface of a paper reel R, wherein the paper web is transferred from the outer surface of the supporting belt rotation directly to the paper reel R to be formed on a reeling core 6. At that point in which the paper web is transferred from the outer surface of the supporting belt rotation 1 to the paper reel R, a first nip contact SN is established. The reeling core 6 is stationary with respect to the machine frame, wherein the supporting belt rotation 1 and the first nip contact SN therein are transferred substantially upwards in the direction of arrow Y when the diameter of the paper reel R grows. According to the invention, there is

at least one second nip contact PN within a distance from the first nip contact SN in the travel direction of the paper web. When the size of the paper reel R grows, the second nip contact PN is also transferred away from the reeling core which is stationary with respect to the machine frame. Thus, according to the method and reel-up according to the invention, the transfer direction can be either directly downwards in accordance with arrow A, or as a combination with the downward directed movement of the arrow, horizontally in the direction of arrow V, wherein the combined effect of the aforementioned movements is directed as a resultant R diagonally downwards. The location of the second nip contact PN can vary ±60° from the vertical line running via the centre of the reeling core 6, wherein the ±60° angular point of the angles opening downwards is located in the fulcrum RYK of the reeling core. The second nip contact PN is advantageously arranged to affect the paper reel R that is being formed, both in the direction of the periphery and the radius of the paper reel, wherein on the periphery of the paper reel R that is being formed, the second nip contact PN covers more than 2% of the outer surface of the paper reel R that is being formed in the direction of the periphery of the paper reel R.

The first nip contact SN is a so-called secondary nip contact, the purpose of which is to minimize the access of air between the layers of paper formed on the paper reel R and to ensure the quality of the paper reel that is being formed. The second nip contact PN, in turn, is intended as a so-called primary nip contact, the purpose of which is to control the formation of the paper reel R. The contact force of the second PN or so-called primary nip contact in the direction of the radius of the paper reel R is effected in such a manner that a vertical component A of the contact force constitutes at least half of the total magnitude of the contact force.

With reference to Figs. 1a to d, the reel-up comprises a closed supporting belt rotation 1 functioning as a guiding means for the paper web, which supporting belt rotation 1 is established by means of guiding reels 2a, via which the endless supporting belt 1a rotates. The supporting belt rotation 1 is connected to the end of the drying section, from which the paper web is passed on top of the supporting belt

rotation to be guided to the reeling up stage. Inside the supporting belt rotation there is a reel change threading apparatus 4 that forms a continuous surface, the function of the apparatus for the part of certain operations being described in more detail hereinbelow. The ends of the reel change threading apparatus 4 are provided with reels 2a, 2b participating in the guidance of the travel of the supporting belt rotation 1 and belonging to the means for establishing a nip contact, especially to the means for establishing a so-called secondary nip contact, i.e. the reel 2a constitutes a first nip member part and the reel 2b a second nip member part. Furthermore, the end of the supporting belt loop 1 accommodating the first nip member part 2a is provided with means for cutting the end of the paper web, i.e. a cutting device 5. In the first embodiment of the reel-up according to Figs. 1a to d, the paper web rotates counterclockwise in accordance with arrow K to the reeling cores 6 and 7, first passing the reel change threading apparatus 4 in the machine direction on top of the supporting belt loop 1, in a substantially horizontal position, travelling away from the end of the drying section 3 and turning towards the drying section 3 at the location of the cutting device and further to the reeling core 6 or 7 in question.

The first basic embodiment of the invention is characterized in that two sets of reeling cores - a first and a second reeling core set - are established. In Figs 1a to d, the reference numeral 6 represents a reeling core belonging to the first reeling core set, and the reference numeral 7 represents a reeling core belonging to the second reeling core set. The reeling cores 6 and 7, which are located in the reeling up station, are placed successively on the same horizontal level in the machine direction, within a horizontal distance from each other in such a way that their central axles are parallel to each other. In the vertical direction, the central axles of the reeling cores 6 and 7 are substantially located by the first 2a and second nip member part 2a, respectively. The reeling cores 6 and 7 are supported from underneath by means of nip member parts 8 and 9 (the reference numeral 8 indicating a third nip member part and the reference numeral 9 a fourth nip member part) for establishing a so-called primary nip contact, which nip member parts belong to the means for establishing a nip contact. During the reeling up process, the fulcrums of the rotating motion of the reeling

cores 6, 7 are substantially stationary with respect to the frame structure of the reel-ups.

Thus, the first 2a and the second 2b nip member part are intended for establishing a so-called secondary nip contact to ensure the quality of the paper reel that is being formed, e.g. to prevent the access of air between the paper layers. The third 8 and the fourth nip member part 9, in turn, are intended for establishing a so-called primary nip contact, i.e. to control the formation of the paper reel, in other words the primary nip contact is utilized to attain a paper reel of desired quality. The nip member parts 8, 9 establishing the first or primary nip contact are located below the central axle of the reeling core 6, 7 of the paper reel that is being formed, and the nip member parts 2a, 2b establishing the second or secondary nip contact, as well as said at least part of the reel change threading apparatus 4, are placed above the fulcrum of the reeling core 6,7 of the paper reel that is being formed.

Fig. 1a shows a situation in which the filling of the reeling core 6 (reel RA) belonging to the first reeling core set is started after the reeling core 7 belonging to the second reeling core set has become full, by guiding the end of the paper web cut by means of the cutting device 5 directly to the reeling core 6. The reeling up process to the reeling core 6 has proceeded so far that the preceding full paper reel has been removed and a new reeling core 7 belonging to the second reeling core set has been brought to the change station.

The fulcrum of the reeling cores 6 and 7 remains substantially stationary with respect to the machine frame during the reeling up process, and the third nip member part 8 is transferred downward in the direction of the arrow P1 (Fig. 1b) so that it maintains the nip contact when the size of the paper reel grows. The secondary nip contact is maintained by the first nip member part 2a. This stage is illustrated in Fig. 1b. According to Fig 1c, the paper reel R1 which is formed on the first reeling core 6 has become full, and the reel change threading (the end KP of the cut paper web) has to be conducted by means of the reel change threading apparatus 4 to the reeling core 7 belonging to the second reeling core set, passing the full paper reel R1

formed on the reeling core 6 belonging to the first reeling core set in the machine direction (the end of the paper web remaining on the paper reel R1 being indicated by the letters KV). According to Fig. 1d, the reel change threading apparatus 4 is detached from the full reel R1 when the reeling of the paper reel to be formed on the reeling core 7 has begun (reel RA) and the full paper reel R1 is ready to be removed after a stoppage.

As can be seen in the embodiment according to Figs 1a to d, the threading unit PV which contains a reel change threading apparatus 4, a first nip member part 2a, a second nip member part 2b and a cutting device 5 for paper web, is transferred vertically during the reeling up process. The end of the threading unit PV accommodating the first nip member part 2a is transferred upward when the formation of the paper reel proceeds, and in a corresponding manner, of course, the end of the threading unit PV at the location of the second reeling core 7 is transferred downward towards the reeling core which is to filled at the next stage (cf. arrow P2 in Fig. 1a) from a position in which it was when the preceding paper reel formed on the reeling core belonging to the second reeling core set became full and it was removed from the reeling up station (the position TR1 of the second nip member part 2b in Fig. 1a). The threading unit PV operates in a corresponding manner, but with the opposite direction of motion, in the reeling up process of a paper reel formed on the second reeling core 7 (i.e. when shifting from the stage according to Fig. 1d to the stage according to Fig. 1a). The first nip member part 2a is in a position TR2 corresponding to the removal of the full reel R1, from which it is transferred downward (arrow P4) into a nip contact with the reeling core 6.

The third and the fourth nip member part 8 and 9 which establish the so-called primary nip contact, are also transferred in a corresponding manner (in Fig. 1b the third nip member part 8 downward, arrow P, from the situation of Fig. 1d upward, arrow P3). In Figs. 1a to d the fourth nip member part 9 is substantially in its upper position due to the presentation sequence, and naturally it moves in corresponding directions (i.e. in the situation of Fig. 1d the nip member part 9 is transferred downwards, arrow P5 and the second nip member part 2b

upwards, arrow P6). The above-presented distances travelled can be illustrated in the form of an equation in the following way:

$$LM_i = (D_{TR}-D_{RY})/2$$

LM_i = the distance travelled by the first and the third nip member part (2a, 8) or the second and the fourth nip member part (2b, 9) in the vertical direction during the reeling up process of the paper reel,

D_{TR} = diameter of the full paper reel, and

D_{RY} = diameter of the reeling core ($D_{RY} > 0$, when the reeling core is a material piece or when a hollow "shell" remains inside the paper reel, $D_{RY} = 0$, when the reeling core is the initial fulcrum of the reeling up process).

To implement the above-described functions, the threading unit PV can be arranged to be transferred in the vertical direction, advantageously to swing with respect to its centre O (In Figs. 1a to d corresponding arrows represent the direction of rotation) by means of suitable members (not shown in the drawings).

Figs. 2a to f illustrate the functions of the basic embodiment according to Fig. 1, seen from the top. Figs. 2a and 2b substantially correspond to a situation which is shown from the side in Fig. 1a. In the situation of Fig. 2a, a full paper reel has been removed from the location of the fourth nip member part 9, in a direction transverse to the machine direction to an arranging station located outside the supporting belt rotation 1, and a new reeling core 7 is fixed on the supporting frame (see Figs. 3 and 4), wherein the reeling core 7 and its supporting frame are transferred in a direction transverse to the machine direction (arrow S1) to the corresponding reeling up station (i.e. reel change station) RVA. In a corresponding manner the reeling up of the reeling core 6 on the support of the third nip member part 8 has started. The reeling core 6 is coupled to a first drive 10a. Fig. 2a shows a situation in which the paper reel forming around the reeling core 6 is at the formation stage, and the second reeling core 7 is placed in a direction transverse to the machine direction to be positioned at the location of the second nip

member part in such a manner, however, that the corresponding second drive 10b is not yet switched on. In Fig. 2c the formation of the paper reel to be formed on the first reeling core 6 proceeds to such a stage in which the second drive 10b is already switched on and the acceleration of the second reeling core 7 and a "capture" of the second nip member part 2b take place, wherein at the final stage of the situation according to Fig. 2c, it is possible to cut the paper web by means of the cutting device 5 and conduct the threading of the end of the cut paper web by means of the reel change threading apparatus 4 to the second reeling core. Fig. 2d illustrates this situation, wherein the reeling to the second reeling core 7 is already in progress, and the paper reel formed on the first reeling core 6 is decelerated. When the formation of the paper reel on the second reeling core 7 proceeds, the full paper reel R1 formed on the first reeling core 6 has already been stopped in the situation according to Fig. 2e, the first drive 10a has been switched off and has been transferred away from the supporting belt rotation 1 (arrow S2) transversely with respect to the machine direction to the arranging station JA. Thus, the full paper reel is removed for the purpose of further processing procedures, and a new reeling core 6 belonging to the first reeling core set is brought to the supporting frame in the arranging station JA (see Figs. 3 and 4), and they are both transferred perpendicularly to the machine direction in contact with the supporting belt rotation 1 (arrow S3) when the formation of the paper reel on the second reeling core 7 is in progress. Thereafter the first reeling core 6 is subjected to procedures similar to those described in connection with Figs. 2b and 2c, wherein they were conducted for the second reeling core 7.

The reeling cores 6, 7 belonging to both reeling core sets can be completely similar to each other, a substantial functional difference being the fact that to the reeling cores 6 belonging to the first set, the paper web is brought directly from the end of the threading unit PV and to the reeling cores 7 belonging to the second set via the reel change threading apparatus 4.

With reference to Figs. 3 and 4, in particular, in the first basic embodiment of the method and reel-up according to the invention, the

supporting frame used for the reeling cores 6, 7 is a reeling carriage 11, which constitutes a fixing frame, on one hand for the means establishing the so-called primary nip contact, i.e. to the third 8 and fourth nip member part 9, and on the other hand for the reeling cores 6 and 7. The cross-section of the fixing frame in the vertical plane perpendicular to the machine direction is U-shaped, wherein the formation of the paper reel takes place partly into the U-shape. The bottom 11a of the fixing frame is provided with a guide arrangement cooperating with the guide means placed on the base on which the reel-up is positioned. This guide means, by means of which the reeling carriage 11 can be transferred in a direction transverse to the machine direction at the point of location of the supporting belt assembly 1 in the vertical direction and away from underneath the supporting belt assembly 1 to the arranging station JA, is generally marked with the reference numeral 12.

Both vertical parts 11b of the U-shaped cross-section of the reeling carriage 11 are provided with a vertical guide arrangement 13, on the support of which the nip member parts 8 and 9 are able to move in the vertical direction. The nip member parts 8 and 9 are formed as a belt roll assembly 14, 15, 16, wherein the two adjacent vertical guides 13a, 13b in the guide arrangement 13 constitute a vertical guide line for the guiding carriages or the like 17 of the belt roll assembly. Thus, the belt roll assembly is formed by at least two rolls 14, 15, of which at least one 14 is driving, as well as an endless belt 16 between these rolls forming a supporting texture rotation, the paper reel that is being formed resting on the upper central part 16a of the same during the formation of the paper reel. According to Fig. 3, the reeling core 6, 7 is supported by means of locking jaws 19 protruding from the upper edge of the vertical parts 11b in the U-shaped cross section of the reeling carriage.

With reference to Fig. 4, in particular, and in view of the technical details, it can be stated that the reeling core 6, 7 contains a bearing housing 18, and the reeling core is extended by a switch 20 of the centre-drive, which is connected to a drive 10a, 10b according to Fig. 2. The axle 14a of the driving roll 14 is extended by a switch 21 by

means of which the drive of the belt roll assembly is switched on (the switch is not shown). Furthermore, in Fig. 4 unbroken lines illustrate the position of the belt roll assembly 14, 15, 16 at a particular formation stage of the paper reel R, and furthermore, broken lines illustrate another position of the belt roll assembly 14, 15, 16, in which it is when the paper reel becomes full. Furthermore, in the situation of Fig. 3, the belt roll assembly is shown with dotted lines, and the paper web with an unbroken line, wherein the second reeling core 7 is at the reeling up stage.

The rolls 14, 15 of the belt roll assembly can be lowered in the guides 13a, 13b of the guide arrangement, either at the same speed when the endless belt 16 is in a substantially horizontal position, wherein the loading affects vertically on the central part of the endless belt 16, or at least partly at different times or simultaneously in such a manner that the endless belt 16 lies in a diagonal position, wherein the loading affects diagonally with respect to the vertical direction.

Further referring to Fig. 5, the second basic embodiment of the invention functions for the part of the threading unit PV in a substantially similar manner as the first basic embodiment, but in view of applying the invention, it is now stationary and the reeling carriage 11, the basic structure of which can be substantially similar to the one described in connection with Figs. 3 and 4, moves in that direction in the machine direction in which the reel change threading apparatus 4 is directed upwards. When the nip member part 8 that establishes a so-called primary nip contact with the paper reel formed on the reeling core 6 is set to move in a corresponding manner in the vertical direction with respect to the reeling carriage 11, a gap opening in the transfer direction of the paper reel is formed, which, on the other hand, is connected to the supporting belt rotation 1, whose contact point with the paper reel that is being formed generates a so-called secondary nip at each point of location of the reel that is being formed. In the situation of Fig. 5, the paper web PR is passed to the reel located nearly in the reel change station. Furthermore, in Fig. 5 dotted lines illustrate two other forming stages of the paper reel (stages V1 and V2).

Figs. 6a to d illustrates a side-view of a reel change situation, wherein when the full paper reel R1 has become full when it is located at the end of the gap, a new reeling core 6' and the reeling carriage 11 have been brought to the reel change station in a corresponding manner, i.e. in contact with the reel change threading apparatus 4, for example with the end of the same. Fig. 6 shows a reel change threading apparatus 4 as a series of successive parallelograms 4a, which illustrate members, for example suction boxes, each of which can be preferably separately activated to a suction effect to guide the cut end of the web in the reel change situation to the reeling core 6' positioned in the reel change station RVA. In the situation according to Fig. 6a, only the sections (two vertically lined parallelograms) of the reel change threading apparatus 4 that are located at the final end of the gap are activated, wherein the paper web is, at its final stages, still guided on the paper reel R1 that is becoming full. Fig. 6b schematically illustrates the cutting stage of the end of the paper web, performed e.g. by means of the cutting device 5. At the same time the entire reel change threading apparatus 4 is activated, i.e. the suction effect is switched on, wherein the cut end P of the paper web passes the full reel R1 under the control of the supporting belt assembly 1, being supported from above and it is transferred to a second reeling core 6' in the reel change station RVA. At this stage it is possible to bring a roll or the like 22 used in connection with the reel change in contact with the reeling core 6', which roll or the like produces a guiding nip contact with the reeling core 6 located in the reel change station RVA. Fig. 6c illustrates a situation in which the cut end KP of the paper web is transferred towards the second reeling core 6 under the guidance of the reel change threading apparatus 4 and furthermore, Fig. 6e illustrates a situation in which formation of the paper reel on the new reeling core 6' is already starting and the full paper reel R1 is decelerated (arrow 23). In the drawing, the supporting belt assembly 1 is illustrated by means of dotted lines, the paper web positioned on the paper reel R1 that is becoming full or on a full paper reel R1 with a thin, unbroken line, and the paper web passed on the new reeling core 6' with a thick broken line. The cut end of the paper web is represented with the letter combination KP. The end of the paper web remaining on the preceding full paper reel is marked with the letter combination KV.

Fig. 7 shows the stages which relate to the implementation of the second basic embodiment of the invention, especially when seen from the above. In Fig. 7a, the reeling of the paper web on the reeling core 6 has been started in the reel change station RVA. The first drive 24 is then switched on. In Fig. 7b the paper reel that is becoming full proceeds in the gap (arrow 25; unbroken lines) leaving the reel change station RVA (dotted lines). In Fig. 7c the first paper reel which is driven by the first drive 24 has become full, and after braking and stoppage it is discharged from the supporting belt assembly 1 in the discharge station PA (arrow 26) to the arranging station JA, in which the finished paper reel is discharged from the reeling carriage functioning as a supporting frame, and a new reeling core 6 is fixed on the supporting frame. The second drive 27, which has been operating in the formation of the paper reel preceding the paper reel formed by the first drive 24, is brought back to the reel change station from the point of location of the discharge station PA in the machine direction is such a way that it is ready to receive a new reeling core 6' (arrow 28). When the new reeling core and the second drive 27 are switched on, the process is substantially in the situation of Fig. 7a, in which the new reeling core 6' is accelerated and it is ready to receive the cut end of the paper web according to Figs. 6c and 6d. The transfers in accordance with the arrows 26 and 28 take place in a direction transverse to the machine direction. From the arranging station JA, it is possible to move the supporting frame at the point of location of the drive 27 in the machine direction (arrow 29).

Claims:

1. A method in reeling up, wherein paper reels are continuously formed on reeling cores from a continuous paper web, **characterized** in that

- the paper reel (PR) is brought to the formation of the paper reel by using a closed supporting belt rotation (1), on the outer surface of the supporting belt rotation (1),
- the paper web (PR) is transferred from the outer surface of the supporting belt rotation (1) directly to the paper reel (R) to be formed on a reeling core,
- a first nip contact (SN) is maintained substantially at that point of the supporting belt rotation (1) in which the paper web (PR) is transferred to the paper reel (R) that is being formed, and
- in addition to the first nip contact (SN), the paper reel (R) that is being formed is affected with at least one, second nip contact (PN).

2. The method according to claim 1, **characterized** in that

- the paper reel (PR) is brought to the formation of the paper reel by using a closed supporting belt rotation (1), on the outer surface of the supporting belt rotation (1),
- the paper web (PR) is transferred from the outer surface of the supporting belt rotation (1) directly to the paper reel (R) to be formed on a reeling core,
- a first or so-called secondary nip contact (SN) is maintained at that point of the supporting belt rotation (1) in which the paper web (PR) is transferred to the paper reel (R) that is being formed, to minimize the access of air between the layers of paper and to ensure the quality of the paper reel (PR) that is being formed, wherein
- in addition to the first or so-called secondary nip contact (SN), the paper reel (R) that is being formed is affected with at least one second or so-called primary nip contact (PN), to control the formation of the paper reel (R).

3. The method according to claim 1 or 2, **characterized** in that at least the second or so-called primary nip contact (PN) is maintained during the reeling process that substantially affects the structure of the paper reel that is being formed.

4. The method according to any of the claims 1 to 3, **characterized** in that the second or so-called primary nip contact (PN) is extended so that it affects the paper reel (R) that is being formed both in the direction of the periphery and the radius of the paper reel.

5. The method according to any of the claims 1 to 4, **characterized** in that the second or so-called primary nip contact (PN) is extended so that it covers more than 2% of the outer surface of the paper reel in the direction of the periphery of the paper reel that is being formed.

6. The method according to claim 1, 4 or 5, **characterized** in that a contact force of the second or so-called primary nip contact (PN) in the direction of the radius of the paper reel (R) is established in such a manner that the vertical component (A) of the contact force is at least half of the total magnitude of the contact force in the direction of the radius.

7. The method according to claim 1 or 4 to 6, **characterized** in that the central point of the point of location of the second or so-called primary nip contact (PN) is altered in the direction of the periphery of the paper reel (R) that is being formed within the range of ±60° (the angular point of the angle in the fulcrum (RYK) of the reeling core (6) in vertical direction).

8. The method according to any of the claims 1 to 7, **characterized** in that the second or so-called primary nip contact (PN) is established by means of a supporting texture rotation (16) separate from the supporting belt rotation (1), which is arranged around a roll assembly (14, 15).

9. The method according to any of the claims 1 to 8, **characterized** in that the reeling core (6) is provided with a driving device, and the reeling core (6) and the paper reel that is being formed are supported from both ends of the reeling core.

10. The method according to claim 1, **characterized** in that the first or so-called secondary nip contact (SN) is formed as a roll nip or a continuous surface (4).

11. A reel-up, which is arranged to continuously form paper reels on the reeling core from a continuous paper web, **characterized** in that the reel-up comprises:

- a closed supporting belt rotation (1) which is arranged to transfer the paper web (PR) to the formation of the paper reel on the outer surface of the supporting belt rotation (1) and from the outer surface directly to the paper reel (R) to be formed on the reeling core (6),
- a first nip contact (SN) substantially at that point of the supporting belt rotation (1) in which the paper web (PR) is transferred to the paper reel (R) to be formed, and
- at least one second nip contact (PN) in addition to the first (SN) nip contact.

12. The reel-up according to claim 11, **characterized** in that the first nip contact (SN) is arranged as a so-called secondary nip contact, especially to minimize the access of air between the layers of paper web and to ensure the quality of the paper reel that is being formed, and said at least one second nip contact (PN) is arranged as a so-called primary nip contact especially to control the paper reel that is being formed.

13. The reel-up according to claim 11 or 12, **characterized** in that the second or so-called primary nip contact (PN) is established by means of a supporting texture rotation (16) which is separate from the supporting belt rotation (1) and arranged around a roll assembly (14, 15), wherein in addition to the contact force in the direction of the

radius of the paper reel (R) the so-called primary nip contact is also effective in the direction of the periphery of the paper reel (R) that is being formed.

14. The reel-up according to any of the claims 11 to 13, **characterized** in that the first or so-called secondary nip contact (SN) is located above said at least one so-called primary nip contact (PN) within a distance in the direction of the periphery of the paper reel (R), and that the so-called primary nip contact (PN) is located at least partly below the paper reel (R) that is being formed to move vertically during the formation of the paper reel.

15. The reel-up according to any of the claims 11 to 14, **characterized** in that the means establishing the so-called primary nip contact (PN) are arranged to be positioned below the paper reel that is being formed in such a manner that the central point of the primary nip contact can be altered ±60° with respect to the vertical direction.

16. The reel-up according to any of the claims 11 to 15, **characterized** in that the second or so-called primary nip contact (PN) is positioned on the support of a reeling carriage (11) or the like functioning as a supporting frame, to move vertically with respect to the reeling carriage.

17. The reel-up according to any of the claims 11 to 16, **characterized** in that the reeling core (6) is positioned in the reeling carriage (11) functioning as a supporting frame in a stationary manner.

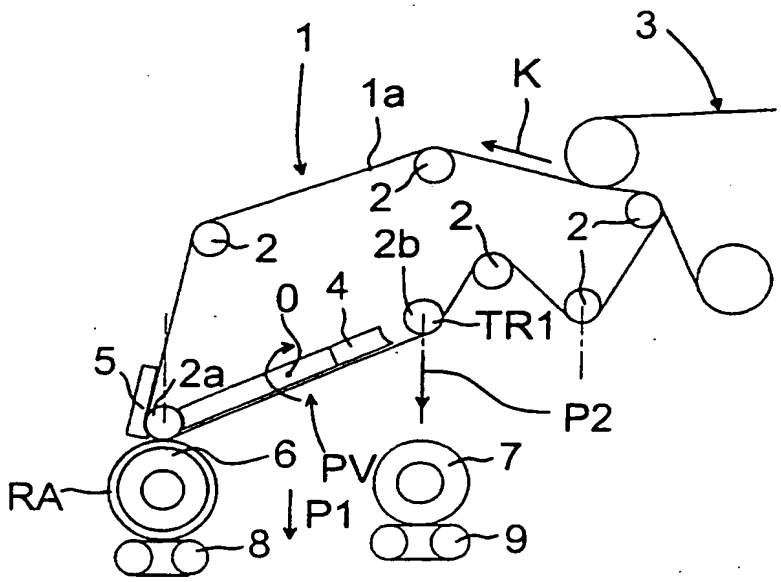
18. The reel-up according to any of the claims 11 to 17, **characterized** in that the first and the second nip contact (SN, PN) above and below the paper reel (R) that is being formed, form a gap opening in the travel direction of the reeling core in such a manner that the travel path of the means establishing the lower, second or so-called primary nip contact (PN) in the machine direction forms the lower part of the gap, and the upper, first or so-called secondary nip contact (SN) is arranged by means of a surface (4) substantially parallel to the longitudinal direction of the paper machine.

19. The reel-up according to any of the claims 11 to 18, **characterized** in that the magnitude of the first or so-called secondary nip contact (SN) is arranged to be determined by the combined effect of the size of the paper reel (R) and the position of the reeling core (6) at a time.

20. The reel-up according to any of the claims 11 to 19, **characterized** in that the first secondary nip contact (SN) is positioned after the fulcrum (RYK) of the reeling core (6) in the travel direction of the reeling core (6).

21. The reel-up according to any of the claims 11 to 20, **characterized** in that the feeding of the paper web (PR) to the reeling up is arranged from a direction opposite to the travel direction of the reeling core (6).

22. The reel-up according to any of the claims 11 to 21, **characterized** in that the means for establishing the first or so-called secondary nip contact (SN) are positioned inside a closed supporting wire rotation intended for the feeding of the paper reel, and that the surface (4) establishing the first secondary nip contact (SN) is arranged to be vacuumized.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1a
K
3
2
2
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P2
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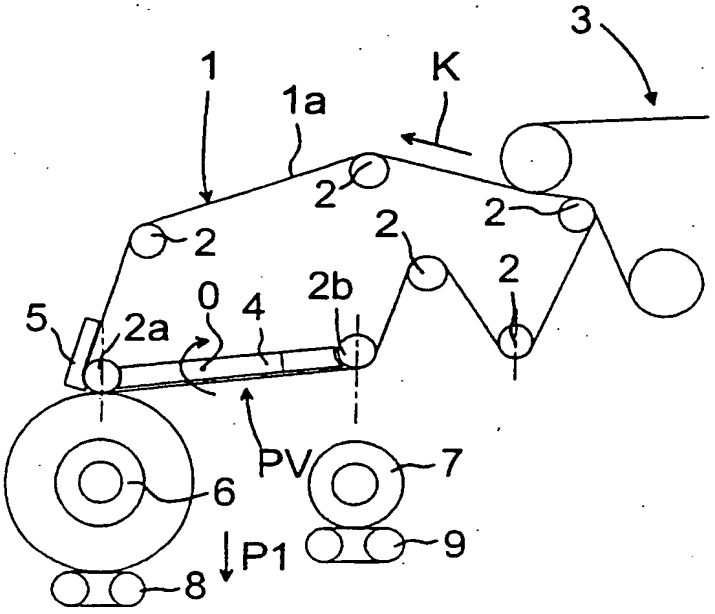
PV
7
RA
P1
8
9

Fig 1a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K
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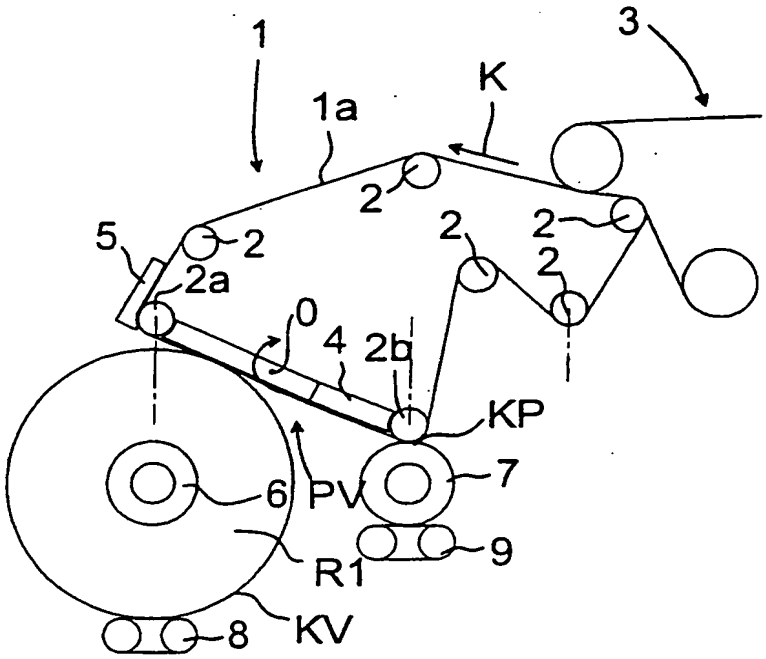
Fig 1b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2a
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4
2b
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9
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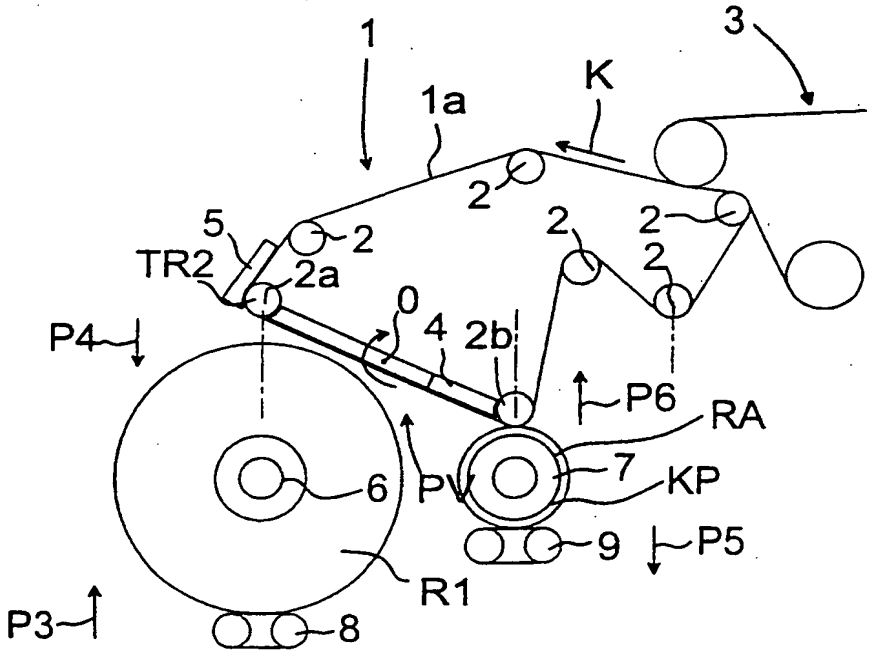
8
KV

Fig 1c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KP
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P5
R1
P3
8

Fig 1d

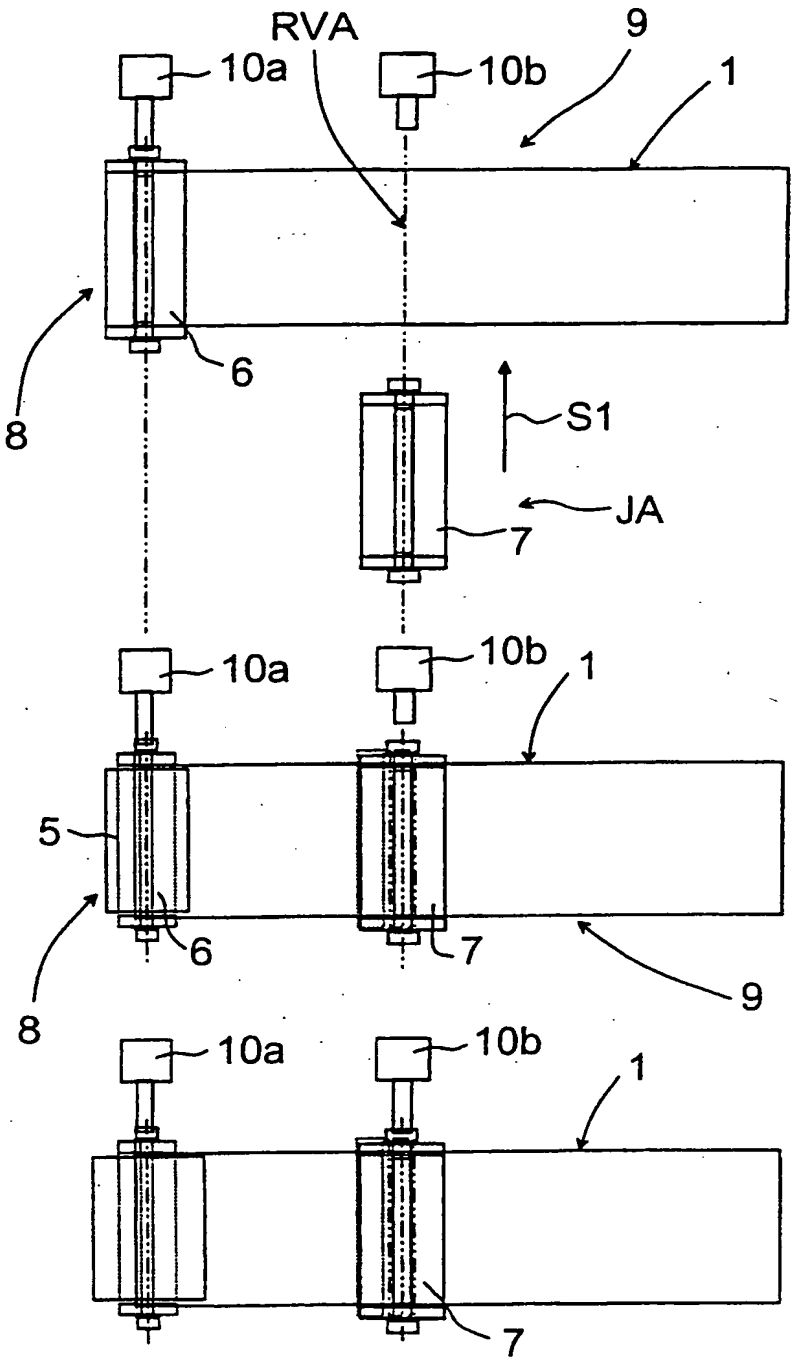


Fig 2a

Fig 2b

Fig 2c

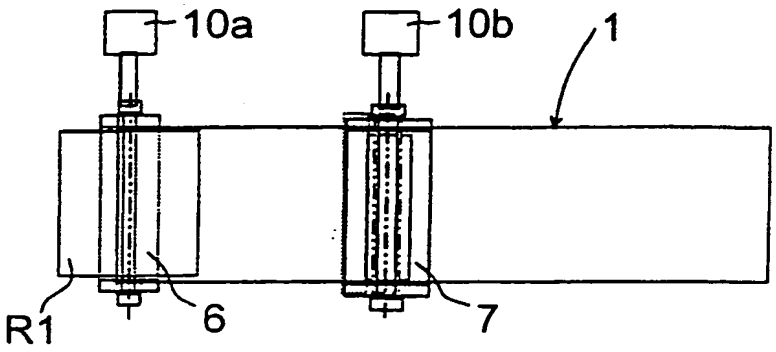


Fig 2d

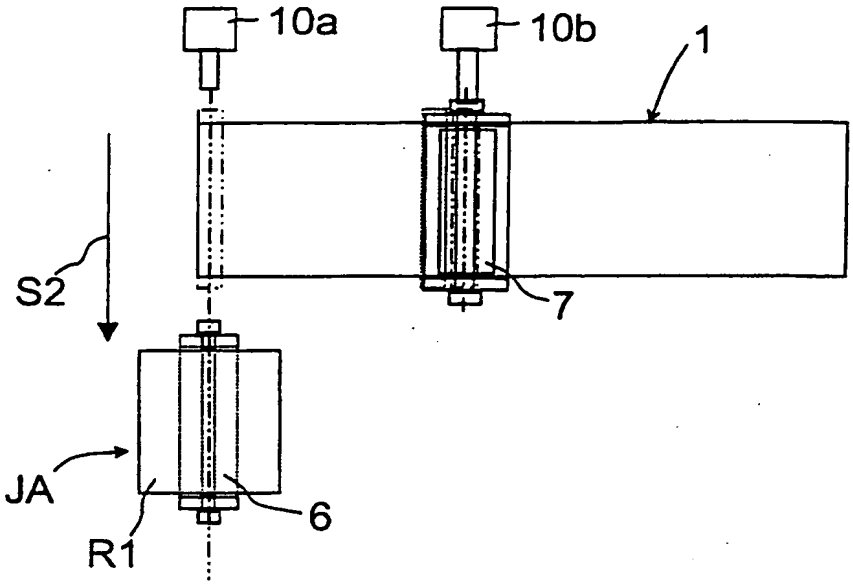


Fig 2e

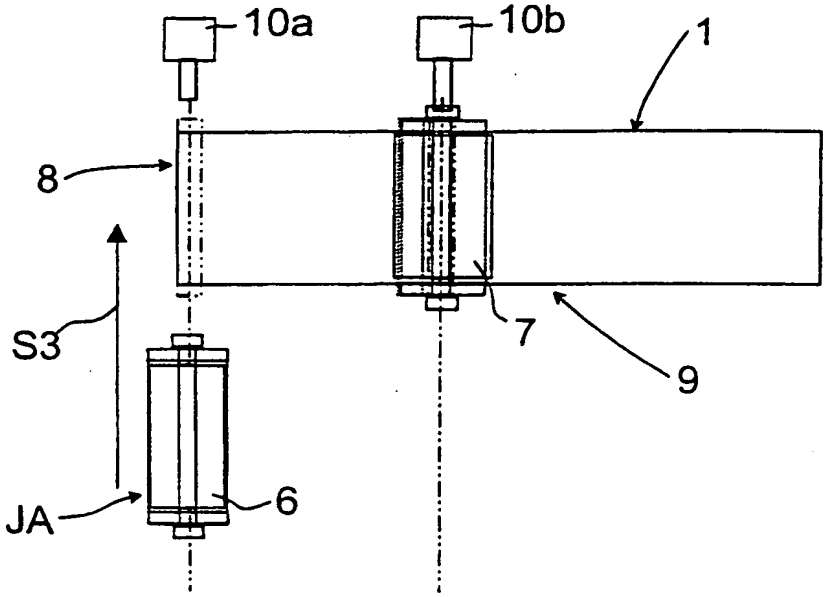
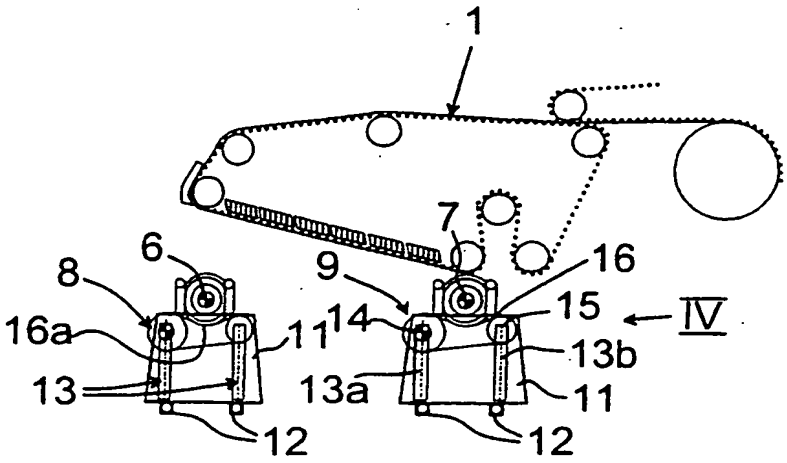


Fig 2f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9
16
8
15
IV
16a
14
11
13b
13
13a
11
12
12

Fig 3

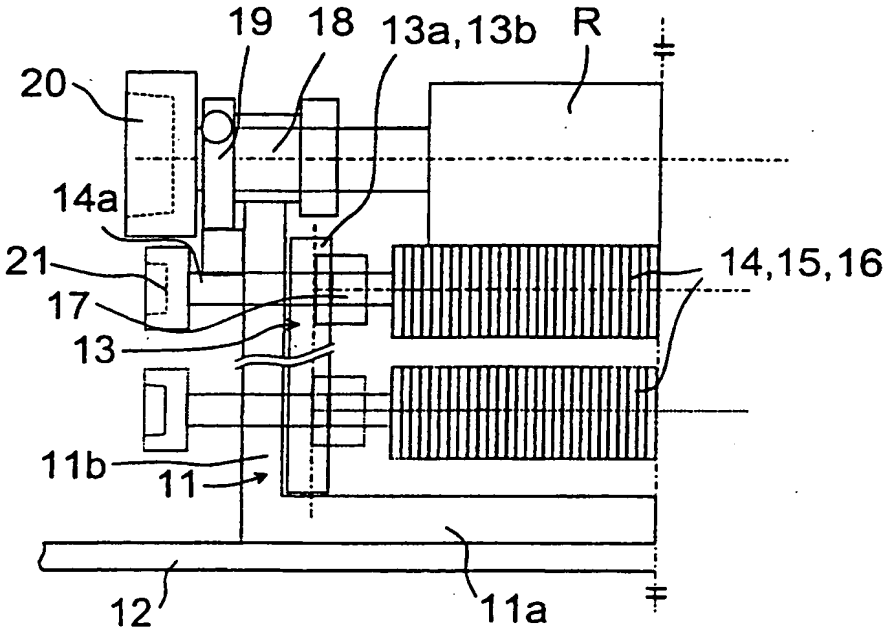
19
18
13a,13b
R
20
14a
21
14,15,16
17
13
11b
11
12
11a

Fig 4

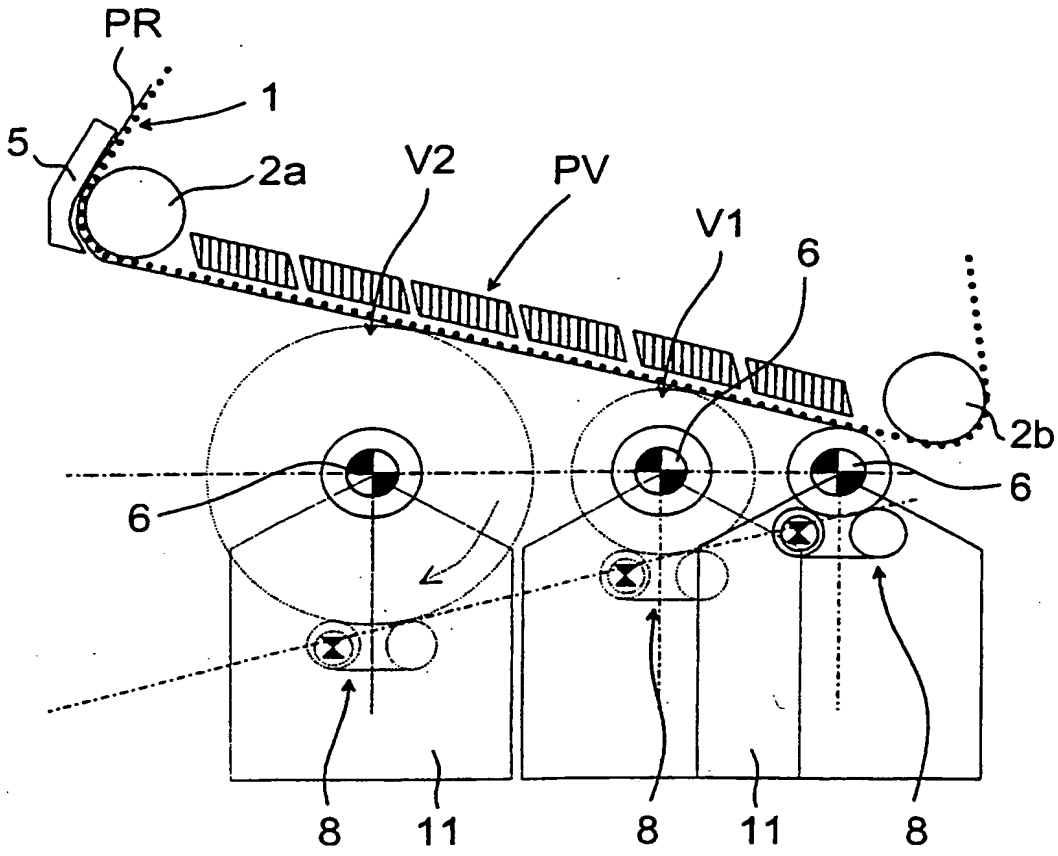

Fig 5

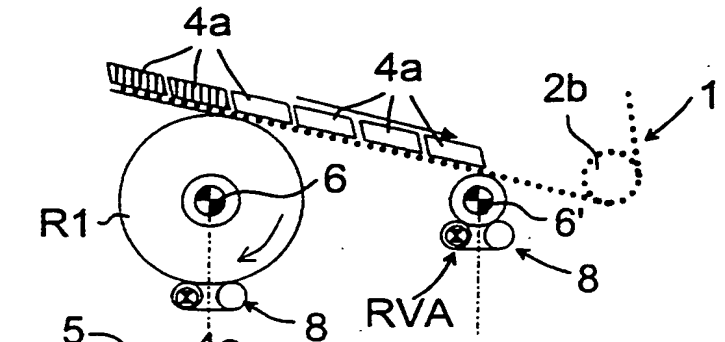

Fig 6a

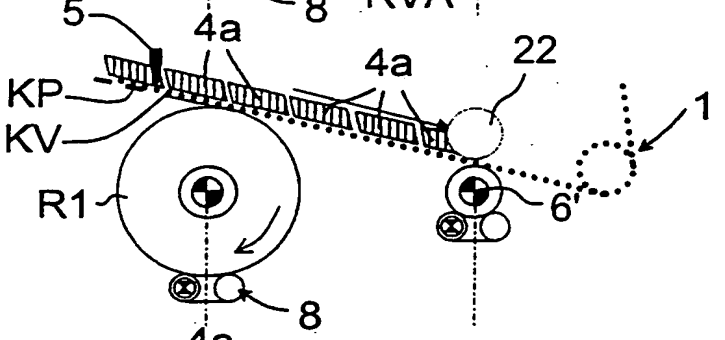

Fig 6b

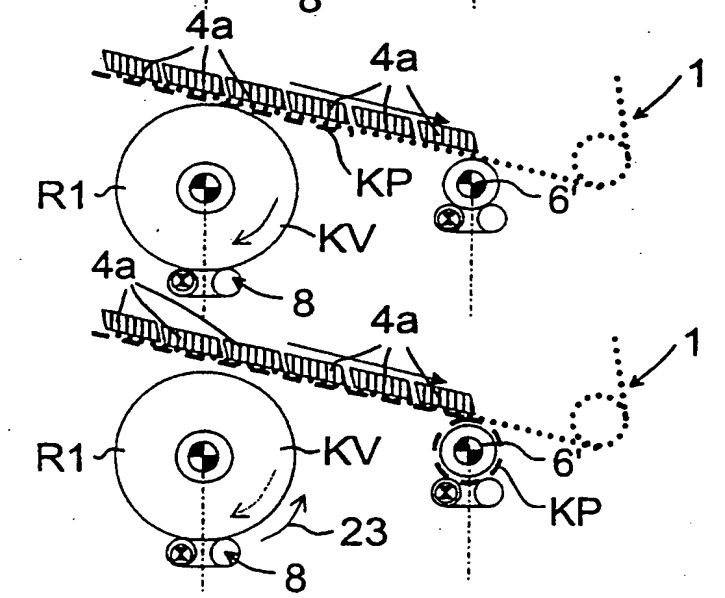

Fig 6c

Fig 6d

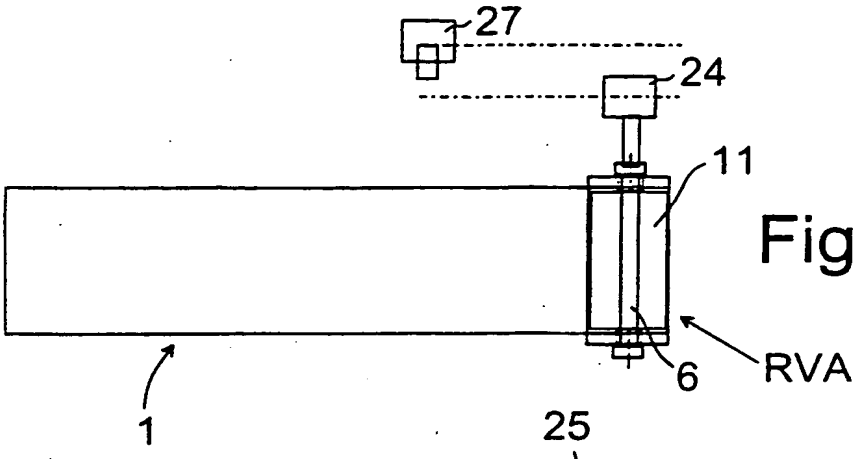

Fig 7a

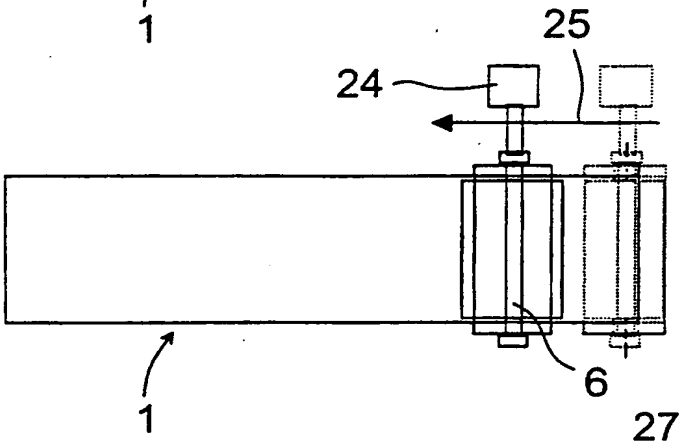

Fig 7b

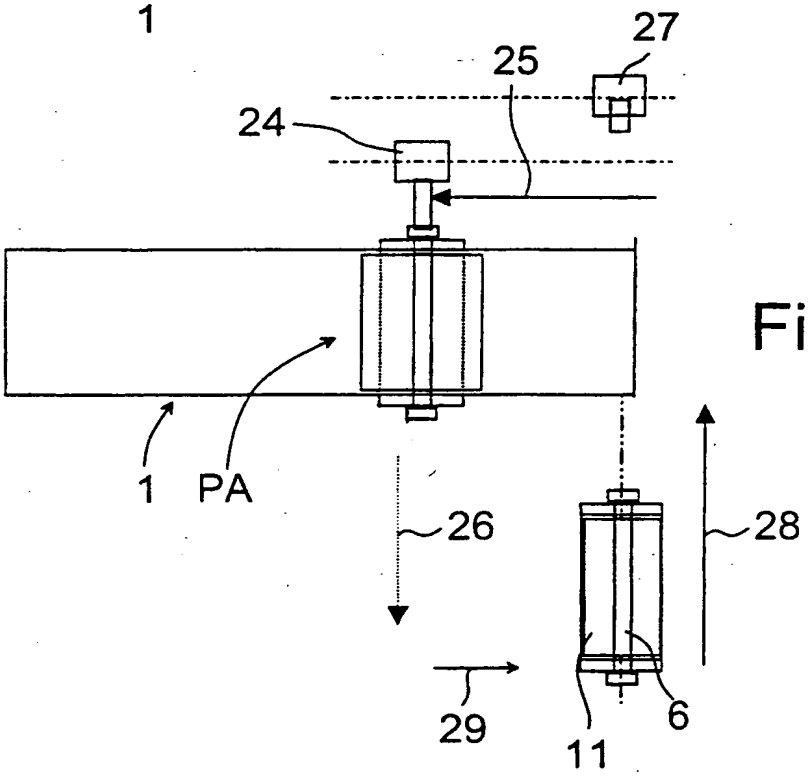

Fig 7c

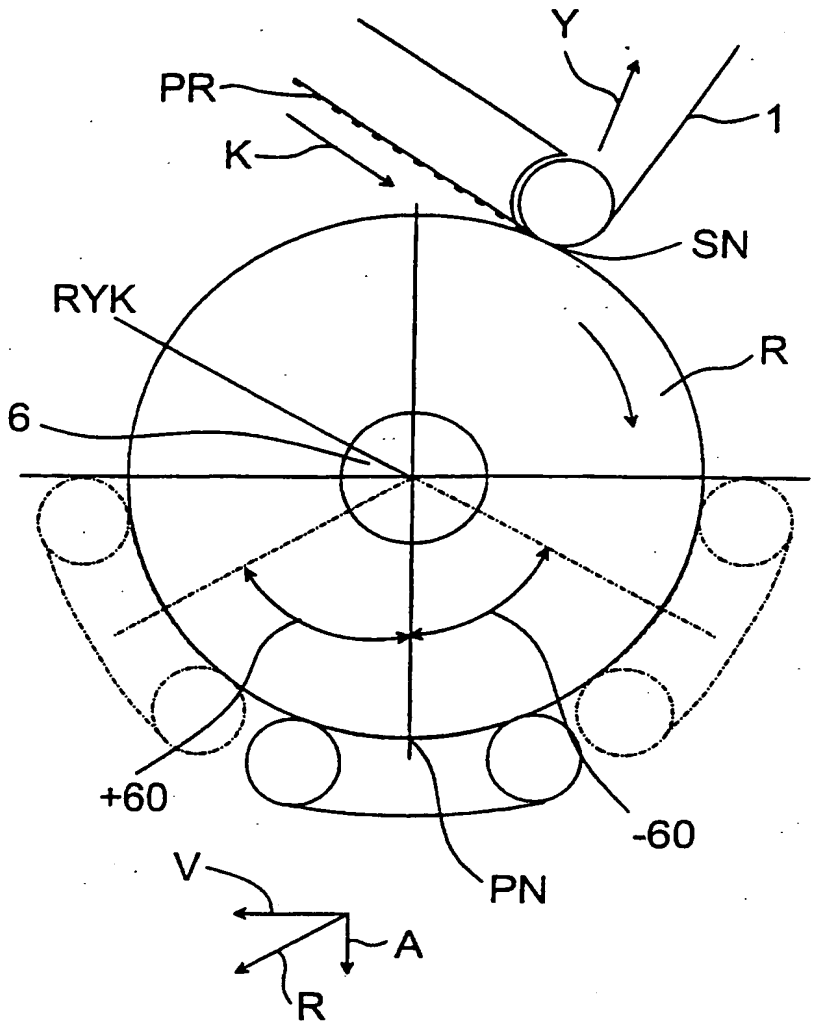

Fig 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00383

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B65H 19/22
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5150850 A (R.J.ADAMS), 29 August 1992 (29.08.92), figure 3, abstract ---	1,11
A	WO 9426641 A1 (BELOIT TECHNOLOGIES INC.), 24 November 1994 (24.11.94), figure 1, abstract --- --------	1-22

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 August 2000	17 -08- 2000
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM	Authorized officer Vilho Juvonen/LR

INTERNATIONAL SEARCH REPORT

Information patent family members

02/12/99

International application No.
PCT/FI 00/00383

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